Do Third Graders Eat Healthful Breakfasts?

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Breakfast nutrient consumption patterns of third graders were examined using data from the Child and Adolescent Trial for Cardiovascular Health (CATCH). Twenty-four-hour recalls, assisted with a food record, were collected in 96 public schools in four States. Ninety-four percent of the children reported eating breakfast on the day of the survey: 80 percent ate at home, 13 percent at school, 3 percent at both locations, and 4 percent elsewhere. Breakfast eaters had lower total daily intakes of fat as a percentage of calories (33 vs. 35 percent) but had higher intakes of calories, vitamins, and minerals than did nonbreakfast eaters. Breakfast contributed 18 percent of total daily caloric intakes; 19 to 34 percent of vitamin and minerals; 13 to 14 percent of total fat, saturated fat, and cholesterol; and 17 percent of sodium intakes. Hispanic and African American children had higher fat and saturated fat breakfast intakes than did Caucasian children. Interventions are needed to encourage primary school students to consume healthful breakfasts.

The diets of primary school children are high in food energy, total fat, saturated fat, and sodium *(8,18,22,35)*. These children are particularly vulnerable to high intakes of saturated fat *(18,35)*, and their intakes of calcium, iron, zinc *(1,4)*, vitamins A, B_6, and C *(6)* are sometimes low. Compared with earlier generations, today's primary school children are increasingly overweight *(9,60)*. Poor diets and less-than-optimal nutritional status may influence later risks for cardiovascular disease and other chronic degenerative diseases *(31,32,33)*. Attention to the quality of children's diets is, therefore, warranted.

Breakfast contributes substantially to the nutritional quality of children's diets *(15,26,28,36,38,40,43,54)*. Eating breakfast is related positively to children's cognitive function and school performance *(6,23,48,49,50,62)*, especially for low-income *(30)* and undernourished children *(48)*. Children's breakfast consumption is also related inversely to two risk factors for cardiovascular disease that persist into adulthood *(31)*: body weight and total blood cholesterol levels *(51)*. Between 5 and 31 percent of school-age children skip breakfast—a particularly common practice among African American girls *(27,37,38)*. Both skipping breakfast and consuming an inadequate breakfast increase the likelihood of dietary inadequacies that are not compensated for by other meals or snacks *(17,27,36,54)*.

The Child and Adolescent Trial for Cardiovascular Health (CATCH) was a multicenter field trial designed to test the effects of school- and family-based interventions designed to reduce risk

factors for cardiovascular disease *(47)*.[1] CATCH provided a unique opportunity to examine the dietary intakes of a large ethnically and geographically diverse group of children *(19,61)*.

This article describes breakfast consumption patterns and nutrient contribution of breakfast meals, measured prior to intervention, when the CATCH sample was in third grade. We compare findings with national goals and results from similar studies. The results may be useful in designing and evaluating health promotion strategies for improving the diets of children.

Methods

Subjects

The total CATCH sample consisted of 5,106 elementary school students from 96 public schools in California, Louisiana, Minnesota, and Texas. Twenty-four schools were in each State: 14 treatment and 10 control. Fifty-nine of these schools (61 percent) had a School Breakfast Program. Before implementing the CATCH intervention, we randomly selected a subsample of 3,486 students from the four States to provide representative 24-hour dietary recalls. Of this subsample, those students who gave their consent and for whom a blood cholesterol level was available were interviewed for baseline measurement (fall 1991) when they were third graders (n=1,920). To evaluate CATCH intervention effects, we also measured students' intakes using a 24-hour dietary recall at follow-up in spring 1994 when they were fifth graders.[2] The final subsample (n=1,920) was representative of the entire CATCH sample on factors such as age, race/ethnicity, and other demographic characteristics. The mean age was 8.7 years (range of 7.6 to 11.2 years) for the third graders who participated.

Dietary Assessment

The interview was a 24-hour recall, assisted with a food record, a method that had been validated for use with third graders *(20)*. CATCH staff asked students to record—briefly—all food and beverages consumed ''from the time they woke up until the time they went to bed.'' The amounts were omitted. The next day, CATCH staff asked each student, during a 24-hour dietary recall interview, to recall everything consumed the previous day. The students' food records were used as a memory prompt. Using three-dimensional food models, two-dimensional shapes, and measuring utensils, children estimated portion sizes. Then they provided the names (breakfast, lunch, snack, and supper), time, and source of each meal (e.g., home, school, restaurants).

CATCH staff collected school breakfast menus and detailed information on recipes, prepared food products, and preparation methods to coincide with the 24-hour dietary recall. Thus, we were able to describe precisely the nutrient intakes from school breakfast meals.[3] Information was not collected on the use of vitamin and mineral supplements or salt added at the table, so results reflect only *food* intake.

Trained and certified interviewers used a standard protocol to collect 24-hour recalls from each child. We used the Minnesota Nutrition Data System, version 2.2 (food database 4A and nutrient data 19, 1990) to calculate breakfast and total daily nutrient intakes. This data system is designed to allow users to link the 24-hour recall with relevant nutrient data on school breakfast. We coded foods and beverages that children consumed at breakfast as breakfast items, and for each child, we summed the nutrients for all foods that had a breakfast code. To ensure data quality, we excluded recalls from the analysis if the amount reported could not be verified with documentation about the intake's unusual size (collected at the study site by nutritionists) and if it also exceeded the 99th percentile values for portions commonly eaten by children *(45)*.

Statistical Analysis

Of the 1,920 children in the sample, 46 were excluded for quality assurance reasons and 2 because meal codes were not specified. The sample for nutrient analysis (n=1,872) was representative of the CATCH group by gender (50 percent each), race/ethnicity (69 percent Caucasian, 12 percent African American, 15 percent Hispanic, and 4 percent Other), and site. (Data are not shown.) Among the analysis sample, 1,765 reported eating breakfast either at home, at school, or both places. Seventy-seven additional students reported eating breakfast at ''Other'' places (e.g., day care, day camp, a friend's house, a store, or in transit) and were not included in the nutrient analyses. Total daily and breakfast intakes for sodium ($p<0.04$) for students eating breakfast at ''Other'' places were significantly higher than sodium intakes for students eating breakfast at home or at school. Also, breakfast intakes of students eating breakfast at ''Other'' places were significantly higher for cholesterol ($p<0.007$), protein ($p<0.02$), and vitamin A ($p<0.05$) and lower for carbohydrate

[1]The main results of the trial are reported elsewhere *(21)*.

[2]Results are presented in detail elsewhere *(27)*.

[3]Details of the CATCH school meal assessment and quality assurance procedures are published elsewhere *(12)*.

($p<0.01$), compared with the intakes of students eating breakfast at home or at school. (Data are not shown.)

To eliminate small cell sizes based on ethnicity and source of breakfast, we excluded 5 students from the analysis. Thus, for the primary analysis of breakfasts eaten at home, at school, or in both locations, 1,683 students were in the sample.

To analyze nutrient intakes at breakfast meals and the percentage of contribution of breakfast to the total daily intake, we used a mixed linear model. We analyzed the dependent variables both in absolute units and relative to the total energy content of breakfast. Site, gender, race/ethnicity, and source of meal were included as fixed independent effects. We assessed interaction terms for gender with race/ethnicity and source of the meal with gender, site, and race/ethnicity. A random effect accounted for between-school variation among sites. Means were adjusted for all factors in the model. Means and standard errors were transformed back to the original units for presentation when log or square root transformations were used to reduce skewness. We used version 6.11 of Statistical Analysis System (SAS) for all computations *(29,52)*.

Results

Breakfast Patterns of Third Graders

Overall, 94 percent of the students reported eating breakfast (table 1). No Asian American students and only 4 percent of Caucasian students reported skipping breakfast, compared with 11 percent of Hispanic and 8 percent of African American students ($p<0.001$). (Data are not shown.) Two percent of the third graders in Minnesota skipped breakfast, compared with 5 percent in California, 6 percent in Louisiana, and 10 percent in Texas ($p<0.001$). Less than one-sixth of the CATCH schools in Minnesota and California provided a School Breakfast Program (14 and 13 percent, respectively), compared with all of the CATCH schools in Louisiana and Texas. (Data are not shown.)

Where Third Graders Ate Breakfast

Most of the students who ate breakfast, did so at home: 84 percent. Only 13 percent ate breakfast at school, and 3 percent ate it both at home and at school. Variations in breakfast consumption patterns among sites were striking. Ninety-eight percent of the students in Minnesota reported eating breakfast, followed by 95 percent of those in California, 94 percent in Louisiana, and 90 percent in Texas. More students in Texas and Louisiana ate breakfast at school (29 and 22 percent, respectively), compared with students in California and Minnesota (2 and 1 percent, respectively).

Differences were not evident in the number of children eating breakfast at home versus at school when only those schools with a School Breakfast Program were examined. (Data are not shown.) Texas and Louisiana (28 percent, each) still had a higher participation rate for school breakfast, compared with California and Minnesota (14 and 4 percent, respectively). (Data are not shown.) That is, simply offering the School Breakfast Program alone did not explain differences among sites. It is difficult to know which factor was associated with this variation, because site and ethnicity are confounded.

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Table 1. Breakfast eating and sources of breakfast of the CATCH sample at baseline in the third grade

Characteristic	Reported eating breakfast		Total	Nutrient analysis sample[1] Source of breakfast					
				Home		School		Both	
	N	%[2]	N	N	%[3]	N	%[3]	N	%[3]
Total	1,765	94	1,683	1,409	84	218	13	56	3
	N	%[4]	N	N	%[5]	N	%5	N	%[5]
Gender									
Boys	878	94	835	697	83	112	13	26	3
Girls	887	94	848	712	84	106	12	30	4
Race/ethnicity									
Caucasian	1,240	96	1,180	1,082	92	76	6	20	2
African American	207	92	198	115	58	59	30	24	12
American Hispanic	253	89	248	153	62	83	33	12	5
Other	65	97	57	57	100	0	0	0	0
Site (% with School Breakfast Program)									
California (13%)	431	95	423	412	97	7	2	4	1
Louisiana (100%)	416	94	397	275	69	87	22	35	9
Minnesota (14%)	484	98	440	434	99	3	1	3	1
Texas (100%)	434	90	423	288	68	121	29	14	3

[1]Native Americans and Asian Americans were combined with ''Other'' race/ethnicity for nutrient analysis. Eighty-two students were excluded: 77 who ate breakfast in places other than at home or school and 5 students who ate breakfast at school.
[2]Percentage of total substudy sample (1,872).
[3]Percentage of nutrient analysis sample.
[4]Percentage of site, gender, or race/ethnicity stratum.
[5]Percentage of site, gender, or race/ethnicity stratum in nutrient analysis sample.

Contribution of Breakfast to Third Graders' Total Daily Nutrient Intake

Students who ate breakfast consumed, on average, significantly more calories daily than those who did not eat breakfast: 1,952 versus 1,544 calories (table 2). Breakfast eaters also had higher intakes of protein, percentage of energy from carbohydrates, sodium, cholesterol, and most vitamins and minerals. Means for both breakfast eaters and nonbreakfast eaters met at least two-thirds of the Recommended Dietary Allowances (RDA's) for energy, protein, vitamin A, ascorbic acid, iron, and zinc *(34)*.

Nonbreakfast eaters' mean intakes fell short of the RDA's for vitamin A and calcium. Compared with nonbreakfast eaters, breakfast eaters consumed a significantly higher percentage of calories from carbohydrates (54 vs. 52 percent). Total fat intake for both groups exceeded the recommendation of 30 percent of calories from fat *(58)*: 33 percent for breakfast eaters and 35 percent for nonbreakfast eaters. Daily sodium (2,891 mg) and cholesterol (204 mg) intakes among breakfast eaters were higher than those of nonbreakfast eaters (2,259 and 142 mg, respectively). Although cholesterol intakes of breakfast eaters and their counterparts met recommended guidelines of no more than 300 mg per day *(33)*, sodium intakes of breakfast eaters exceeded the guideline.

Breakfast contributed about 18 percent of the third graders' mean energy intakes, 17 percent of total protein, 22 percent of carbohydrate, and 13 percent of total fat consumed (table 3). Fourteen percent of total daily amounts of both saturated fat and cholesterol, 17 percent of sodium, and 19 to 34 percent of daily vitamin and mineral intakes came from breakfast. (Data are not shown.) Compared with girls' breakfasts, those for boys

Table 2. Total daily nutrient intakes of children eating breakfast, compared with those not eating breakfast,[1] CATCH

Variable	Goal	Breakfast eaters N = 1,765	Nonbreakfast eaters N = 107	Breakfast eaters vs. nonbreakfast eaters P[2]
Energy (calories)	>1,340[3]	1,952 (17)	1,544 (48)	<0.001
Protein (% calories)	NA[4]	14.7 (0.1)	15.1 (0.1)	0.30
Carbohydrate (% calories)	NA[4]	54.0 (0.2)	51.5 (0.8)	0.003
Total fat (% calories)	<30[3]	32.5 (0.2)	34.6 (0.7)	0.002
Saturated fat (% calories)	<10[3]	12.7 (0.11)	13.0 (0.3)	0.28
Sodium (mg)	<2,400[5]	2,891 (33)	2,259 (97)	<0.001
Cholesterol (mg)	<300[5]	204.4 (3.5)	141.6 (10.1)	<0.001
Protein (g)	>19[3]	71.9 (0.7)	58.0 (2.2)	<0.001
Vitamin A (RE)	>467[3]	908 (15)	455 (39)	<0.001
Ascorbic acid (mg)	>30[3]	89.8 (2.1)	52.0 (5.4)	<0.001
Iron (mg)	>7[3]	13.4 (0.2)	9.1 (0.5)	<0.001
Calcium (mg)	>871[6]	1,043 (15)	745 (37)	<0.001
Zinc (mg)	>7[3]	9.59 (0.11)	7.18 (0.28)	<0.001

[1]Adjusted mean (standard error): model-adjusted by site, race/ethnicity, and gender.
[2]Testing hypothesis of equal mean between breakfast eaters and nonbreakfast eaters.
[3]Goal based on the Dietary Guidelines for Americans *(58)*, National School Lunch Program and School Breakfast Program: School Meals Initiative for Healthy Children *(57)*.
[4]Does not apply.
[5]Values are two-thirds of the 1989 Recommended Dietary Allowances *(34)* for 7- to 10-year-old children.
[6]Value is two-thirds of the 1998 Dietary Reference Intake *(55)*.

Students who ate breakfast consumed... more calories daily than those who did not eat breakfast:...

supplied 1 to 4 percent more of their daily intakes on 11 of the 12 nutrients analyzed ($p<0.05$). Boys' and girls' intake of ascorbic acid was not significantly different.

The contribution of breakfast to total daily intakes of fat, saturated fat, and cholesterol differed by site (all $p<0.001$). (Data are not shown.) Breakfast at all sites provided 20 percent or more of daily intakes of ascorbic acid and iron. Differences in other nutrients were also evident ($p<0.05$).

Nutrient Content of Third Graders' Breakfast Meals

Table 4 presents mean breakfast intakes of food energy and selected nutrients among third graders overall, by gender, and by race/ethnicity. All interaction terms in table 4, as well as tables 5 and 6, were statistically nonsignificant ($p>0.10$); thus, results are tabulated for main effects only (e.g., site, gender, race/ethnicity, and source of meal). The tables also provide one-quarter of the RDA goals *(34)*, the Dietary Guidelines' goals *(58)* recommended by the U.S. Department of Agriculture's (USDA)

Table 3. Percent contributions of breakfast to daily nutrient intakes,[1] CATCH

Variable	Goal[2]	Overall N = 1,683	Gender			Site				
			Boys	Girls	P[3]	California	Louisiana	Minnesota	Texas	P[3]
Energy (calories)	500	18.4 (0.3)	19.0 (0.4)	17.8 (0.4)	0.004	17.3 (0.6)	18.8 (0.6)	17.8 (0.8)	19.7 (0.6)	0.06
Protein (g)		16.5 (0.3)	17.0 (0.4)	16.0 (0.4)	0.03	16.2 (0.7)	17.0 (0.6)	15.6 (0.8)	17.3 (0.6)	0.36
Carbohydrate (g)	NA[4]	21.6 (0.4)	22.2 (0.5)	21.0 (0.4)	0.02	21.2 (0.8)	20.6 (0.6)	21.9 (1.0)	22.7 (0.7)	0.19
Total fat (g)		12.7 (0.4)	13.3 (0.5)	12.2 (0.4)	0.04	11.2 (0.7)	15.1 (0.7)	10.6 (0.9)	14.4 (0.7)	0.0001
Saturated fat (g)		14.3 (0.4)	14.9 (0.5)	13.7 (0.5)	0.03	13.0 (0.8)	17.1 (0.7)	11.7 (1.0)	15.8 (0.8)	0.0001
Sodium (mg)	<600	16.6 (0.4)	17.4 (0.5)	15.7 (0.4)	0.0007	16.6 (0.8)	16.6 (0.6)	15.7 (0.9)	17.4 (0.7)	0.55
Cholesterol (mg)	<75	14.1 (0.5)	14.9 (0.7)	13.3 (0.6)	0.03	13.3 (1.1)	16.8 (1.0)	10.8 (1.2)	15.8 (1.0)	0.0015
Vitamin A (RE)	175	34.4 (0.8)	36.5 (1.0)	32.3 (0.9)	0.0003	33.9 (1.6)	32.7 (1.2)	35.8 (2.2)	35.0 (1.4)	0.52
Ascorbic acid (mg)	11	23.3 (0.9)	23.4 (1.1)	23.1 (1.1)	0.81	19.5 (1.7)	22.6 (1.5)	24.1 (2.4)	27.2 (1.8)	0.02
Iron (mg)	3	26.9 (0.5)	28.0 (0.7)	25.9 (0.6)	0.005	26.0 (1.1)	23.8 (0.8)	29.3 (1.5)	28.8 (1.0)	0.0004
Calcium (mg)	325	26.4 (0.5)	27.3 (0.7)	25.6 (0.6)	0.01	27.0 (1.1)	27.7 (0.9)	24.3 (1.3)	26.9 (1.0)	0.22
Zinc (mg)	3	19.4 (0.4)	20.2 (0.5)	18.7 (0.5)	0.01	19.4 (0.8)	19.3 (0.6)	20.0 (1.1)	19.1 (0.7)	0.93

[1]Adjusted mean (standard error); N=1,683 children.
[2]Goals based on National School Lunch Program and School Breakfast Program: School Meals Initiative for Healthy Children *(57)*, 1989 Recommended Dietary Allowances *(34)*, and National Academy of Sciences, Diet and Health: Implications for Reducing Chronic Disease Risk *(33)*.
[3]Testing hypothesis of equal means across gender or site.
[4]NA - not applicable.

School Meal Initiative for Healthy Children *(57)*, and the Diet and Health Report of the National Academy of Sciences *(33)*.

Overall, the adjusted mean energy intake at breakfast was 337 calories, with about 14 percent of energy from protein, 65 percent from carbohydrate, 23 percent from total fat, and 10 percent from saturated fat (table 4). Mean sodium and dietary cholesterol intakes from breakfast were 459 and 32 mg, respectively. The average energy intake at breakfast was significantly lower among girls than boys (317 vs. 358 calories). Similar results were noted for protein intake expressed in grams. Compared with girls, boys consumed significantly more sodium, dietary cholesterol, vitamin A, iron, calcium, and zinc at breakfast. But gender differences disappeared after adjustment for differences in food energy intakes. (Data are not shown).

Compared with other students, African American and Hispanic students consumed higher percentages of energy in their breakfasts from total fat (23 and 26 percent, respectively) and saturated fat (11 and 12 percent, respectively) (table 4). Compared with other children, Hispanic children consumed less energy from carbohydrates (61 percent vs. 65 to 68 percent). The students' intakes of energy, calcium, and zinc at breakfast did not meet the dietary goals for any of the race/ethnic groups.

The nutrient profiles of breakfasts differed among sites, with Minnesota breakfasts having the most healthful nutrient profiles (table 5). Compared with other breakfasts, those in Minnesota had the lowest percentage of calories from fat (19 percent), saturated fat (8 percent), and dietary cholesterol (21 mg). Also, breakfasts in Minnesota had the highest percentage of calories from carbohydrate (70 percent), vitamin A (363 RE), and iron (4.3 mg). Compared with breakfasts at other sites, those in Texas and Louisiana had more total fat, saturated fat, and dietary cholesterol; exceeded the goal for saturated fat and sodium; but did not contain more food energy. Breakfasts in Louisiana were also lower in vitamin A, ascorbic acid,

Table 4. Energy and selected nutrients for breakfast meals, by gender and race/ethnicity,[1] CATCH

Variable	Goal[2]	Overall	Gender			Race/ethnicity					
			Boys	Girls	P[3]	Caucasian	African American	Hispanic	Asian	Other	P[3]
Energy (calories)	500	337 (7)	358 (9)	317 (8)	<0.001	333 (78)	347 (16)	342 (15)	314 (32)	396 (42)	0.30
Protein (% calories)	NA[4]	13.6 (0.2)	13.6 (0.2)	13.6 (0.2)	0.84	13.7 (0.2)	13.0 (0.4)	13.7 (0.4)	14.3 (0.9)	10.8 (1.0)	0.013
Carbohydrate (% calories)	NA[4]	65.0 (0.5)	64.9 (0.6)	65.2 (0.6)	0.68	65.6 (0.6)	65.9 (1.2)	61.3 (1.2)	65.0 (2.9)	68.3 (3.0)	0.014
Total fat (% calories)	<30	23.1 (0.4)	23.4 (0.5)	22.9 (0.5)	0.49	22.5 (0.5)	23.4 (1.1)	26.3 (1.0)	21.8 (2.4)	21.7 (2.5)	0.011
Saturated fat (% calories)	<10	10.4 (0.2)	10.5 (0.3)	10.2 (0.3)	0.30	9.9 (0.2)	10.7 (0.5)	12.2 (0.5)	9.4 (1.2)	9.8 (1.2)	<0.001
Sodium (mg)	<600	459 (12)	491 (14)	428 (13)	<0.001	456 (13)	483 (27)	447 (24)	487 (60)	449 (59)	0.76
Cholesterol (mg)	<75	32.0 (1.7)	34.9 (2.2)	29.1 (2.0)	0.015	29.2 (1.8)	38.7 (4.6)	39.1 (4.4)	33.0 (9.6)	37.3 (10.6)	0.06
Protein (g)	7.0	11.7 (0.2)	12.5 (0.3)	11.0 (0.3)	<0.001	11.7 (0.3)	12.0 (0.6)	11.9 (0.6)	11.6 (1.3)	10.7 (1.3)	0.95
Vitamin A (RE)	175	309 (9)	335 (12)	284 (11)	<0.001	314 (11)	332 (23)	269 (20)	379 (57)	241 (47)	0.067
Ascorbic acid (mg)	11	21.2 (1.2)	21.6 (1.4)	20.8 (1.4)	0.56	20.1 (1.3)	25.8 (3.0)	20.8 (2.6)	24.4 (6.5)	36.0 (8.1)	0.064
Iron (mg)	3	3.8 (0.1)	4.1 (0.1)	3.5 (0.1)	<0.001	3.8 (0.1)	4.3 (0.3)	3.4 (0.2)	3.8 (0.6)	3.1 (0.6)	0.11
Calcium (mg)	325[5]	273 (6)	293 (8)	255 (7)	<0.001	278 (7)	272 (15)	266 (14)	248 (32)	205 (30)	0.38
Zinc (mg)	3	1.70 (0.05)	1.85 (0.06)	1.57 (0.05)	<0.001	1.67 (0.05)	1.84 (0.12)	1.70 (0.11)	2.26 (0.35)	1.47 (0.23)	0.13

[1]Adjusted mean (standard error); N=1,683 children.
[2]Goals based on National School Lunch Program and School Breakfast Program: School Meals Initiative for Healthy Children *(57)*.
[3]Testing hypothesis of equal means across gender or race/ethnicity.
[4]NA - not applicable.
[5]Value is one-quarter of the 1998 Dietary Reference Intake *(55)*.

and iron, compared with other sites. At all sites, the breakfasts eaten by children did not meet intake goals for energy, calcium, and zinc.

Most breakfast intakes were similar, whether eaten at home or at school (table 6). Children who reported eating breakfasts *both* at home and at school, however, had significantly ($p<0.05$) higher breakfast intakes of food energy, protein, and of most other nutrients. Breakfast intakes for percentage of food energy from saturated fat and sodium exceeded goals for children eating breakfast both at home and at school. Their breakfast intakes were 705 Kcal, compared with 326 Kcal for those eating breakfast at home only and 334 Kcal for those eating breakfast at school only ($p<0.05$). Similarly, total daily energy intakes were 2,397 Kcal for children who consumed breakfasts both at home and at school, compared with 1,928 Kcal for children who ate breakfast at home only and 1,976 Kcal for those who ate breakfast at school only. (Data are not shown.) No differences were apparent in body mass indices by gender or by race/ethnicity for the children who ate breakfast at both places on the same day versus those who ate breakfast once: at home or at school. (Data are not shown.) Most (63 percent) of those eating breakfast at both home and school were from Louisiana.

Mean food energy and most selected nutrient intakes from breakfast were not significant by source of the meal (i.e., whether eaten at home or school or both) (table 6). The exception was iron. Compared with home breakfasts, school breakfasts, on average, contributed significantly lower amounts of iron (2.3 vs. 3.8 mg) and contributed less than the 3-mg dietary goal. This finding persisted across sites, gender, and the three race/ethnic groups ($p>0.20$ for interaction; data are not shown). Whether consumed at home or at school, both breakfasts exceeded goals for percentage intake from saturated fat (10 and 11 percent, respectively); both were low in energy, calcium, and zinc. In Louisiana and

Table 5. Energy and selected nutrients for breakfast meals by site,[1] CATCH

Variable	Goal[2]	Overall	Site				
			California	Louisiana	Minnesota	Texas	P[3]
Energy (calories)	500	337 (7)	312 (13)	336 (12)	342 (17)	361 (13)	0.08
Protein (% calories)	NA[4]	13.6 (0.2)	14.4 (0.3)	13.4 (0.3)	13.3 (0.4)	13.3 (0.3)	0.07
Carbohydrate (% calories)	NA[4]	65.0 (0.5)	67.0 (1.0)	60.1 (0.8)	69.9 (1.3)	63.2 (0.9)	<0.001
Total fat (% calories)	<30	23.1 (0.4)	21.0 (0.9)	27.5 (0.7)	18.8 (1.1)	25.2 (0.8)	<0.001
Saturated fat (% calories)	<10	10.4 (0.2)	9.6 (0.4)	12.3 (0.4)	8.3 (0.6)	11.2 (0.4)	<0.001
Sodium (mg)	<600	459 (12)	419 (22)	463 (20)	446 (28)	510 (22)	0.04
Cholesterol (mg)	<75	32.0 (1.7)	29.7 (3.3)	40.0 (3.2)	20.6 (3.6)	39.8 (3.4)	<0.001
Protein (g)	7.0	11.7 (0.2)	11.4 (0.5)	11.4 (0.4)	11.5 (0.6)	12.6 (0.5)	0.24
Vitamin A (RE)	175	309 (9)	307 (19)	240 (14)	363 (26)	333 (17)	<0.001
Ascorbic acid (mg)	11	21.2 (1.2)	18.2 (2.2)	17.2 (1.8)	24.0 (3.2)	26.1 (2.4)	0.015
Iron (mg)	3	3.8 (0.1)	3.6 (0.2)	3.0 (0.2)	4.3 (0.3)	4.2 (0.2)	<0.001
Calcium (mg)	325[5]	273 (6)	274 (12)	256 (10)	283 (16)	281 (11)	0.32
Zinc (mg)	3	1.70 (0.05)	1.71 (0.09)	1.57 (0.07)	1.86 (0.13)	1.68 (0.08)	0.23

[1]Adjusted mean (standard error); N=1,683 children.
[2]Goals based on National School Lunch Program and School Breakfast Program: School Meals Initiative for Healthy Children *(57)*.
[3]Testing hypothesis of equal means across site.
[4]NA - not applicable.
[5]Value is one-quarter of the 1998 Dietary Reference Intake *(55)*.

Texas, breakfasts consumed at school were higher ($p<0.02$) in the mean percentage of energy from total fat and saturated fat and lower ($p<0.03$) in energy from carbohydrate than were breakfasts consumed at home. The relative contribution of breakfast to total daily intakes did not vary by source of breakfast (e.g., home or school). (Data are not shown.)

Discussion

We found that only 6 percent of the third grade students in the Child and Adolescent Trial for Cardiovascular Health (CATCH) skipped breakfast. This is the same predicted rate for 6- to 10-year-olds included in the USDA's School Nutrition Dietary Assessment study (SNDA) *(15)*. Other large studies of primary school children, however, reported higher percentages of children who skipped breakfast *(14,15,44)*. In the SNDA study, but not in the CATCH study, the percentage of students who ate breakfast were constant across regions of the country, whether or not the child's school offered a School Breakfast Program. But where children who ate breakfast did differ among sites, more CATCH third graders than SNDA 6- to 18-year-olds consumed breakfast at home (84 vs. 69 percent). Comparisons are difficult, however, because older children skip breakfast more often than younger children do *(15)*. Sixteen percent of CATCH students ate a School Breakfast Program meal, compared with the 25-percent prediction for 6- to 10-year-olds in the SNDA study. Three-fifths of CATCH schools provided a School Breakfast Program; about two-fifths of schools in the SNDA study did so (61 vs. 45 percent, respectively).

SNDA concluded that the availability of a School Breakfast Program did not influence whether a student ate breakfast. The Bogalusa Heart Study, however, reached the opposite conclusion. In the Bogalusa longitudinal study, prior to widespread availability of the School Breakfast Program, the percentage of children who skipped breakfast was high, ranging from 9 percent in 1973 to 30 percent in 1979. When the School

Table 6. Energy and selected nutrients for breakfast meals, by source of meal,[1] CATCH

Variable	Home N = 1,409	School N = 218	Home and school N = 56	P[2] (Home v. school)
Energy (calories)	326 (6)	334 (31)	705 (82)	0.76
Protein (% calories)	13.7 (0.1)	13.4 (0.8)	12.6 (1.1)	0.70
Carbohydrate (% calories)	65.2 (0.4)	64.6 (2.6)	63.0 (3.3)	0.87
Total fat (% calories)	22.9 (0.4)	23.7 (2.2)	26.5 (2.8)	0.74
Saturated fat (% calories)	10.2 (0.2)	11.3 (1.0)	11.7 (1.3)	0.30
Sodium (mg)	448 (10)	427 (51)	838 (90)	0.70
Cholesterol (mg)	31.2 (1.4)	27.3 (8.0)	71.2 (16.3)	0.66
Protein (g)	11.4 (0.2)	11.2 (1.2)	22.4 (2.1)	0.85
Vitamin A (RE)	307 (8)	260 (43)	546 (79)	0.30
Ascorbic acid (mg)	21.4 (1.0)	15.8 (4.8)	37.3 (9.2)	0.31
Iron (mg)	3.8 (0.1)	2.3 (0.4)	9.0 (1.1)	<0.01
Calcium (mg)	264 (5)	276 (30)	518 (53)	0.73
Zinc (mg)	1.65 (0.04)	1.67 (0.23)	3.70 (0.65)	0.89

[1]Adjusted mean (standard error); N=1,683 children.
[2]Testing hypothesis of equal means between breakfast eaters by source of meal.

Breakfast Program became widely available, the percentage of students skipping breakfast declined dramatically *(42)*. In CATCH, the availability of the School Breakfast Program did not affect the percentage of students who skipped breakfast. Compared with students in Minnesota and California (84 and 79 percent, respectively), lower percentages of students in Texas and Louisiana (63 and 70 percent, respectively) ate breakfast at home, and slightly higher percentages skipped breakfast, even after we controlled for the availability of the School Breakfast Program. Although household income data were unavailable for individual CATCH children, we suspect that Texas and Louisiana schools had more children from poor and minority families (as determined by ethnic distribution and number of children eligible for free or reduced-price school meals at each site).

The contribution of breakfasts eaten at home or at school as a percentage of total daily intakes was similar for most nutrients. However, for the small number of children who consumed breakfast *both* at home and at school, daily food energy intakes were higher, mostly accounted for by the extra food energy at breakfast. Children who ate two breakfasts, however, did not weigh more than other children weighed. Because most of those eating breakfast twice came from sites where more schools were considered low income, it is possible the children were from poor families with limited access to food at other meals and snacks, and the children relied on the School Breakfast Program to supplement their intakes. Alternatively, the children may have been especially hungry, because they were growing rapidly.

In a related study by our group *(11)*, we found the amount of calories provided by 5 consecutive days of CATCH school breakfast menus at baseline was similar to the data reported here. In the SNDA study, breakfasts consumed at home provided only 18 percent of the RDA for food energy for students overall, and only 10 percent of the students who participated in the School Breakfast Program met or exceeded the target of 25 percent of the RDA for food energy at breakfast *(7)*. Food energy provided in the School Breakfast Program in CATCH conformed to the program's regulations at the time of the baseline study.

Regulations adopted after the CATCH program started require that school breakfasts provide 25 percent of the RDA of 2,025 Kcal per day for children 6- to 11-years-old or about 500 Kcal and an equivalent proportion of other nutrients *(57)*. If schools provide only 25 percent of the RDA, on average, it is unlikely that 25 percent will be consumed, because children rarely eat all of their food. In other analyses, however, we found that CATCH third graders' intakes of both total daily energy and macronutrient intakes were adequate *(19)*. Snacks and other meals consumed throughout the day may have compensated for reduced intakes at breakfast in this study. Because total dietary intakes of students nationwide exceeded the RDA for energy *(8)*, perhaps 25 percent of the RDA is not as critical for food energy consumption at breakfast as it is for vitamins and minerals.

Breakfast eaters also had higher intakes of protein, percentage of energy from carbohydrates, sodium, cholesterol, and most vitamins and minerals.

When the SNDA students' daily dietary intakes were examined, researchers found that students participating in the School Breakfast Program consumed more than the 25-percent target of the dietary goals for fat, saturated fat, and cholesterol that is specified by the National Cholesterol Education program *(31)*. Those eating breakfasts at home consumed less of these nutrients and food energy *(7)*. In contrast, students' breakfast intakes, regardless of whether they were at home, at school, or at both home and school, exceeded the 25-percent target of the RDA's for most nutrients (except zinc). This result underscores the contributions of breakfast to nutritional quality *(7,34)*.

Many aspects of SNDA's data collection and methods of analysis were similar to those used by CATCH. SNDA, however, did not incorporate analysis of actual school recipes and vendor foods into the 24-hour recalls of students who ate school meals: This may have required greater use of generic recipes and food entries (defaults) than were used in CATCH analysis. Using defaults can result in higher nutrient estimates overall and may explain some of the differences in food energy contributions of the School Breakfast Program between the two studies *(2)*.

CATCH third graders consumed breakfasts that were consistent with national nutrition goals for dietary intakes of total fat (no more than 30 percent of energy), saturated fat (10 percent or less of energy), sodium (600 mg or less), and cholesterol (75 mg or less) *(31,58)*. For CATCH third graders, overall, breakfasts contributed only 13 percent of their daily total fat, 14 percent of their saturated fat, and 16 percent of their sodium intakes. Hence, consumption at other meals or snacks must be responsible for the excessive 24-hour intakes of these nutrients *(19)*. Overall, school breakfast intakes did not meet the goal of less than 10 percent of energy from saturated fat among Hispanics (12 percent of calories) or among children in Louisiana (12 percent) and Texas (11 percent). Variation by sites suggests regional differences in food preparation methods, and types of foods consumed may also influence the nutrients consumed at breakfast *(37)*. To meet fat intake goals for Healthy People 2000 *(59)*, we need intervention efforts that focus on school meals and breakfasts among children in these race/ethnic groups; in different regions; and for lunches, snacks, and dinners.

Mean intakes of protein (g), vitamin A, ascorbic acid, and iron at breakfast contributed at least 30 percent of the RDA's for these nutrients for all gender, regional, and race/ethnic groups among CATCH third graders. The exception was among the small number of girls of ''Other'' race/ethnicity *(34)*. These findings confirm the importance of school breakfasts in enhancing the quality of children's nutrient intakes *(41)*. Based on the new calcium DRI's *(55)*, intakes of calcium at breakfast were below the 25-percent goal of the RDA's for all groups. Average daily calcium intakes, however, met about 80 percent of the AI (adequate intake).

Among CATCH third graders (and also among participants in other studies such as SNDA), mean zinc intakes at breakfast were less than one-fourth of the RDA. But on a daily basis, the children's intakes reached recommended levels; therefore, there was little cause for concern *(8)*. One way to improve the zinc content of school breakfasts, while meeting the dietary goals for fat intake, is to include fortified, ready-to-eat cereals.

For example, a recent study shows that children who consumed ready-to-eat cereal at any time in a 24-hour period had significantly higher total daily intakes of zinc, compared with those who did not consume ready-to-eat cereals *(42)*.

When we analyzed the 24-hour recalls, we found that iron in the meals of the School Breakfast Program in CATCH schools was about one-third of the RDA (31 to 34 percent) *(11)*. Among third graders eating breakfast at school, iron intake at breakfast was slightly lower (23 percent of the RDA) than the desired percentage of the RDA. Among those eating breakfast at home, iron intake was higher (38 percent of the RDA) than the desired percentage. We attribute this finding to children not eating all their breakfast and sampling variability. The SNDA study, in contrast, found iron intakes at breakfast were adequate (40 to 43 percent of the RDA), regardless of the source of the meal *(7)*.

The study reported here has several limitations. Socioeconomic status could not be assessed for each child, thus relevant adjustments could not be made for factors that could have produced different findings for the subgroups. Use of only a single 24-hour recall on each child is another limitation. Thus, usual intakes could not be assessed. Also, evidence shows that 24-hour recalls systematically underestimate food intakes by 10 to 20 percent; therefore, actual intakes may have been higher than those reported. But no reason exists to suspect that breakfast intakes were underreported differentially *(17)*. Hence, it is likely that among CATCH third graders, mean total calorie intakes may have been higher than the 18 percent of the RDA reported here.

Moreover, our data consist of weekday food intake; it is likely that breakfasts vary between weekdays and weekends *(39)*. Some children may have reported snacks as part of the breakfast meal, and others may have reported foods eaten at breakfast as snacks. This type of reporting introduces error into the analysis. Because it was not feasible to collect quantitative data on discretionary salt used by this population, our estimates of total dietary sodium are incomplete. Also, we did not measure intakes from vitamin and mineral supplements.

Conclusion

Our most striking finding confirms the adage that children who eat breakfast tend to have more healthful daily intakes than those who do not eat breakfast. Also, eating breakfast—at home or at school—increased children's daily intakes of several vitamins and minerals and decreased the percentage of calories from fat. Although breakfast is a valuable meal for children, it is less and less likely to be consumed by adults *(16)*. If the availability of breakfast at home decreases because parents are not eating it, the availability of school breakfast becomes more important for enhancing the chances that children will eat healthful breakfasts.

There are, however, economic and other barriers to implementing breakfasts in many schools. Thus, encouraging breakfast consumption—at home or at school—should be a priority in health promotion programs for children. This is particularly important among African American and Hispanic students who skip breakfast more often and in regions of the country where skipping breakfast is more prevalent. It is important among adolescents because breakfast consumption tends to decline during the second decade of life. Skipping breakfast is more prevalent among children from low-income than higher income families, but low-income children are also more likely to participate in the School Breakfast Program when it is available than are higher income children.

Information on changes in the food supply *(13)* and in children's eating patterns *(1,44)* must be considered if health promotion programs about children's meals are to be effective. Therefore, it is important to monitor children's eating behaviors and dietary intakes *(3,46,53,56)*. It is also important that intervention programs and new initiatives for healthy children provide strategies for decreasing fat, saturated fat, and sodium in breakfasts. These programs also need to include recommendations on how to incorporate foods that are energy-dense and rich in vitamins and minerals.

The U.S. Department of Agriculture and others have joined in a campaign on child nutrition and health that has made child nutrition an immediate priority *(25)*. Children must be guided to make healthful decisions. We nutritionists, policymakers, and information multipliers must direct new efforts to better understand children's eating behaviors and psychosocial factors that influence their food-related decisions.

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